

Meeting Summary
National Earthquake Prediction Evaluation Council (NEPEC)
September 17-18 at USGS, Golden, Colorado

Attending:

NEPEC Members:

Terry Tullis, Brown University (Chair)
Ramon Arrowsmith, ASU
Nick Beeler, USGS, Menlo Park
Roland Bürgmann, UC Berkeley
William Ellsworth, USGS, Menlo Park
David Jackson, UC Los Angeles
Andrew Michael, USGS, Menlo Park
Evelyn Roeloffs, USGS, Vancouver, WA
Allan Rubin, Princeton University
Bruce Shaw, Columbia University
John Vidale, University of Washington

USGS Hosts and NEPEC Staff:

Jill McCarthy, Geological Hazards Science Center (GHSC) Director
Michael Blanpied, USGS (NEPEC Executive Secretary)
Joyce Costello, USGS, Reston (not attending)
David Mason, USGS, Golden - notetaker

Guests:

Harley Benz, USGS, Golden
Paul Earle, USGS, Golden
Edward (Ned) Field, USGS, Golden
James Goltz, CA Emergency Management Agency
Joan Gomberg, USGS, Seattle (by phone)
Gavin Hayes, USGS, Golden
Peter Powers, USGS, Golden
Mark Petersen, USGS, Golden
David Wald, USGS, Golden

Day 1 – UCERF3 and the NEIC:

On the first day of the meeting, the NEPEC was provided with three briefings on the Uniform California Rupture Forecast, version 3 (UCERF3), a statewide earthquake occurrence model being developed by a multi-institutional Working Group on California Earthquake Probabilities (WGCEP) led by the USGS. The UCERF3 project is a collaborative effort of the USGS, the California Geological Survey (CGS), and the Southern California Earthquake Center (SCEC). Major financial support comes from the California Earthquake Authority, though an agreement

managed by SCEC. The USGS is making major in-kind contributions of staff time to the project, and SCEC is contributing high-performance computational power and expertise.

Ned Field, who chairs the Executive Committee (ExCom) of the WGCEP, described the UCERF3 project, which aims to create a time-independent model that forecasts the locations, magnitudes, and rates of all California earthquakes above M~6.5. Following will be a time-dependent version, and then a version that focuses on short-term spatio-temporal clustering. UCERF3 makes several advances over previous models. Among the most innovative changes are a relaxation of segmentation, use of geodetic data to constrain slip rate on faults throughout the model, inclusion of many more faults than in previous models, and the use of an inversion technique to identify likely models that best satisfy a broad suite of observations and constraints. Field said that the very large number of potential rupture sources (>200,000) makes the solution problem challenging and difficult to interpret. Questions from Council members focused on logic tree weighting, uncertainties, and differences between UCERF3 and previous models.

Mark Petersen, who leads the National Seismic Hazard Mapping Project in Golden, outlined plans and issues involved with adopting the forthcoming UCERF3 time-independent model, which will be published as a joint USGS-CGS document. One issue is that of timing—the model must be delivered, and sufficiently understood, in time (ideally, December 2012) to be incorporated into drafts of the national seismic hazard maps that will be posted for comment in April or May of 2013. The project will rely on the Scientific Review Panel (SRP), NEPEC, and others to provide guidance on whether the model is sufficiently ready to be used in these important maps. It is critical that there be sufficient understanding of—and trust in—the UCERF3 model for the engineering committees responsible for seismic design provisions and building codes to accept the USGS hazard model. There followed a detailed discussion among Council members and others regarding the UCERF3 model, differences from the previous UCERF2 model, and how to handle changes in the calculated California hazard resulting from the different approaches.

Bill Ellsworth, chair of the SRP, described the planned review process for the UCERF3 report and its many appendices. Each appendix in the Open File Report (OFR) will be independently reviewed. The entire product will be issued as joint report by USGS and CGS. The following discussion focused on the role of NEPEC in providing a brief, overarching review and approval (should approval be the answer) of the UCERF3 report, and the timing of that action. NEPEC chair Terry Tullis requested that the SRP provide a report summarizing their views and results from the review process, as major input to the NEPEC's deliberations. A rough time frame of late 2012 was discussed. Jim Goltz said that CEPEC hopes to review the initial report as well, and to discuss with NEPEC their findings.

The main meeting was adjourned at this point. Council members were then given a tour of the National Earthquake Information Center (NEIC) by its director, Harley Benz.

Day 2 – OEF and the Pacific Northwest:

The Council was briefed by Lucy Jones and Mike Blanpied on USGS plans for an enhanced capability in Operational Earthquake Forecasting, which involves the dissemination of

authoritative information about temporal changes in seismic hazard and risk, such that users can take precautionary actions as warranted. A new strategic plan calls for an integrated program of research, model development and testing, message design and testing, implementation of forecast software and products within the existing seismic networks, and continuous assessment of user needs and how well those needs are being met.

Jones described work with social scientists and communication experts on understanding and improving risk communication to the general public and other groups. She explained that testing of risk messages is absolutely critical, and goes hand-in-hand with message design to determining what products would best convey useful information and to develop explanatory material. Several factors have been identified as pivotal in the understanding of risk messages and the likelihood that they will result in appropriate actions. A key point is that there must be close coordination with emergency responders and other expert, decision-making groups, to understand what decisions they need to make and to what earthquake forecast information best supports their responsibilities.

Field and Jones led a discussion of the relative merits of various existing and planned forecast models, including the STEP (Short-Term Earthquake Probabilities) model and the forthcoming UCERF3 short-term model that will employ calculations based on an ETAS (Epidemic-Type Aftershock Sequence) model. A key factor is what assumption (constraint) is made about the magnitude-frequency distribution of seismicity, and over what regions that constraint applies.

Andy Michael updated the NEPEC on results from the five-year RELM (Regional Earthquake Likelihood Models) forecast comparison/competition, and advances offered by the Collaboratory for Study of Earthquake Predictability (CSEP). He recommended a path forward toward improved OEF, which includes identifying successful elements of tested algorithms, and conducting sensitivity tests to identify the most important parameters. He advocates a combination of prospective and retrospective testing to most efficiently test candidate models.

Harley Benz outlined the status of efforts at the NEIC relevant for OEF, and said that he and his staff need guidelines on how to focus priorities in order to best support improved forecasting. In discussion, issues of communication were highlighted, including the challenges of communication with regional networks during an aftershock sequence, and the pros and cons of delivering information to users while understanding and products are rapidly evolving following a major earthquake.

Following a break the NEPEC engaged in a discussion of the OEF issues in order to develop recommendations sought by the USGS. Tullis argued that the term “OEF” was confusing and would create unreachable expectations. He urged the USGS to find a different term. At the end of the discussion, Tullis summarized the sense of the Council that the strategic plan for OEF was good and worth pursuing. He said that the Council would look forward to results from studies of risk perception psychology, and suggested that the USGS set as a near-term goal the ability to issue aftershock forecasts throughout the nation (a capability currently only existing within California).

After lunch, the NEPEC was given updates on issues involving communication and collaboration with decision-makers in the Pacific Northwest, a topic covered in several previous meetings. Joan Gomberg (attending by phone) presented a draft subcommittee report that had been solicited by the NEPEC, which summarizes situations in which there may be forewarnings of

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major earthquakes in the Cascadia region. Planning for efficient communication is challenging, because earthquakes are rare in the region, because there is little known about what factors may occur that will raise a sense of alarm among scientists or the public, and because there are many agencies and groups involved, including those with action plans in place or in production.

Gomberg was asked to all input she has heard from this discussion and incorporate it into the report. Goltz offered to contribute comments off-line as well. Gomberg said that she would aim to create an updated report within two weeks and would append it with a list of key contacts for organizations from the response and policy community in the region.

Lucy Jones again took the floor to describe discussions with emergency managers in California on how best to serve earthquake forecast information to them in ways that aid with decision-making. In discussion, the meeting participants created a substantial list of earthquake scientists and public officials in the Cascadia region who could profitably attend a workshop to discuss these issues. Tentative plans were made to host such a meeting in Seattle.

The meeting concluded with a return to the topic of earthquake frequency-magnitude distributions, and how to distinguish whether it is appropriate to model earth behavior with an assumption of characteristic earthquakes.

The meeting was adjourned at 3:30 PM, and members were invited to attend a talk by the USGS's Rob Williams on investigations of the 2011 Mineral, Virginia earthquake and plans for expanded research efforts in the eastern U.S.